Volume 2 SEPTEMBER, 1923 Number 9

JOURNAL

OF THE

AMERICAN WELDING SOCIETY

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33 West Thirty-ninth Street, New York

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OF THE
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AMERICAN WELDING SOCIETY
ESTABLISHED 1919
JOURNAL

Volume 2 SEPTEMBER, 1923 Number 9

FALL MEETING
of the
American Welding Society
To Be Held
In PITTSBURGH, PA.
OCTOBER 24, 25 and 26, 1923

Headquarters for the Convention will be at the
FORT PITT HOTEL
and unless otherwise stated all meetings will take place there

All Sessions Start Promptly as Scheduled

WEDNESDAY, OCTOBER 24, 1923

MORNING

9:30 a. m. to 12. **Opening Session Third Fall Meeting**

(a) Address of Welcome—J. D. Conway, Chairman, Pittsburgh Sect.
(b) General Statement of Society's Affairs—T. F. Barton, President, A. W. S.
(c) General Discussion of the Following Subjects—
1. General Interest in Section Meetings
2. Journal
3. Membership
4. Promotion of Welding

AFTERNOON

2:00 p. m. to 5. **Industrial Application Session**

(a) Report on the Industrial Applications of Welding and Its Possibilities—E. H. Ewertz, General Manager Moore Plant Bethlehem Shipbuilding Co.
(b) General Relations of Society to the Industry—T. F. Barton, President, A. W. S.
(c) Technical Work of Society—C. A. Adams, Director, American Bureau of Welding

EVENING

7:00 p. m. **Fall Dinner of the American Welding Society**
English Room, Fort Pitt Hotel

This is another get-together entertaining dinner meeting. As usual plenty to eat and good talent. Bring along your friends. Tickets ($5.00 per person) may be obtained by writing to the Secretary. Be sure to make your reservations early.

THURSDAY, OCTOBER 25th, 1923

MORNING

9:00 a. m. to 11:00 **Electric Arc Welding Committee**
H. M. Hobart, Chairman

Several important items are listed on the agenda including arc welding of non-ferrous metals, structural steel and thin sheet metal, speed and cost of welding and arc welding standards.

9:00 a. m. to 11:00 **Executive Committee, A. W. S.**

11:00 a. m. to 12:00 **Joint Session Board of Directors, A. W. S. and Executive Committee Amer. Bureau of Welding.**

AFTERNOON

11:50 p. m. **Inspection Trip—Westinghouse Electric and Mfg. Co., East Pittsburgh**

Note: This inspection trip will be preceded by a luncheon. Members are requested to assemble in the lobby of the Fort Pitt Hotel at 11:50 a. m. and proceed from there to the Pennsylvania Station and take the 12:10 train to E. Pittsburgh. The Westinghouse Electric and Mfg. Company will provide a luncheon for the members of the American Welding Society.

EVENING

8:00 p. m. **Meeting with Pittsburgh Railway Club**
Fort Pitt Hotel

Note: The American Welding Society has been invited to attend the annual meeting of the Pittsburgh Railway Club as their guests. The meeting consists of a very brief business session and the remainder of the evening is given over to entertainment features for which the Club is famous. A dinner will precede the meeting at which members of the Society are also invited. Admission tickets will be furnished to our members upon presentation of their American Welding Society membership card at the door.

FRIDAY, OCTOBER 26th, 1923

MORNING

9:30 to 11:30 — **Gas Welding Committee**
S. W. Miller, Chairman

Digest of available information on the gas welding of pipe lines and manganese steel will be reviewed. Plans for further activities will also be discussed.

9:30 a. m. to 11:30 — **Joint Meeting Membership Committee and Vice-Presidents, American Welding Society**

AFTERNOON

12:20 p. m. — **Inspecton Trip, Carnegie Steel Plant**

Members should assemble at the P. & L. E. Railroad Station in time to board the 12:30 train for the Carnegie Steel Plant at Homestead. This allows the members sufficient time to have their lunch before train time. The inspection trip will include a visit to the Openhearth, Blooming Mill and Welding Divisions.

2:00 p. m. to 5:00 — **Committee on Training of Operators**
J. C. Wright, Chairman

It is expected that at this session the Course on the Training of Arc Welders will be completed. This Course will be similar to that of the Course for the Training of Oxy-Acetylene Welders published several months ago.

EVENING

8:00 p. m. — **Pittsburgh Section Meeting and the A. W. S.**

1. How the Insurance People Feel Towards Welding—Dr. A. D. Risteen, Travelers Insurance Company
2. The Relation of the Railways to the Public—Author to be delegated by the Committee on Public Relations of the Eastern Railroads.

IMPORTANT NOTICE

Out of town members are requested to register at the Fort Pitt Hotel. Thru the courtesy of the management of the Hotel meeting rooms have been provided without expense to the Society.

Members are requested to bring along their membership cards as admission in several instances will be made by this card.

CONVENTIONS AND MEETINGS

Meetings of the Society and Sections are held for one purpose—the advancement of the art of welding. It takes time and money to plan and conduct successful meetings. This time is for the most part given gratuitously on the part of busy men who are officers of the Society and Sections. There is no hope for award on their part; in fact only severe condemnation if these meetings are not successful. Speakers are carefully selected and their traveling expenses come out of their own pockets or the firms with which they are connected. It is only fair and courteous that in return meetings should be well attended.

Nearly all of these meetings are of great inspirational and educational vlaue. Experiences of the foremost welding experts in the country are given freely. Questions are answered that in many cases result in savings of hundreds of dollars. An opportunity is also provided for the exchange of information and ideas among the welders themselves thereby giving them a real live interest in their work.

The value of meetings to members or companies depends upon attendance. It is true that the most important papers are published in the Juornal of the Society, but nevertheless this is not the same as receiving first hand information from the author and hearing the discussion which generally follows the presentation of these papers. Attendance is the best way to keep abreast of the latest developments. By this exchange of information advancement may be made in a few months which would normally take years of single effort.

The American Welding Society will hold its third fall convention during the latter part of October. With this convention the work of the Society and the Sections for the coming year is formally launched. If you can at all do so, it is your duty to attend as well as your privilege. This message is meant not only to arouse your interest in the fall meeting but also for your continued support to the meetings of your Section during the coming year. The Meetings and Papers Committee with the aid of the local officers of your section are doing all they can to make these meetings worth while and profitable. They are endeavoring to meet the wishes of the majority of members of the section as to the type of subjects and papers to be delivered. Their efforts will only be partially successful unless they have your cooperation. One of the foremost experts in the welding field recently made a public statement that he learns something at every meeting of his section that he attended and he never misses one unless it is physically impossible for him to attend.

TEN WAYS OF NOT HELPING

(Jersey City Lodge 211 B. P. O. E. Bulletin)

1. Don't go to the meetings.
2. If you do go, go late.
3. If the weather don't suit you, don't think of going.
4. If you do attend a meeting, find fault with the work of the officers and members.
5. Never accept office, as it is easier to criticize than to do things.
6. Get sore if you are not appointed on committee, but if you are do not attend committee meetings.
7. If asked to give your opinion on some matter, tell him you have nothing to say. After the meeting tell everyone how things should be done.
8. Do nothing more than absolutely necessary, but when members use their ability to help matters along, howl that the institution is run by a clique.
9. Hold back your dues, or don't pay at all.
10. Don't bother about getting new members, "Let George do it."

TESTING STARTED BY WELDED RAIL JOINT COMMITTEE

The test joints called for in the preliminary series of tests of the Welded Rail Joint Committee to determine the "present state of the art" have nearly all been made up and shipped to the Bureau of Standards, University of Illinois and Purdue University where they will be given conductivity, tensile, impact and bend tests. The actual work of testing has already been started and a preliminry report showing test results will be available for discussion at the next

meeting of the Committee which will be held during the annual convention of the A. E. R. A. in Atlantic City. The meeting is scheduled for Wednesday morning at 10 A. M., October 10th in the Engineering Meeting Room on Young's Million Dollar Pier.

It is also planned to have an exhibition in the A. E. R. A. booth some samples broken up under the various types of tests. Photographs of all joints tested to date will also be available.

Aside from the actual program of improving the art of making welded joints by the various processes the Committee has served a useful function as a clearing house for information on welding problems arising in the Way Department of Street Railways.

PRESSURE VESSEL INVESTIGATION

For the information of our members there is given below a complete financial statement showing the contributions and expenditures made in connection with the investigational work of the Pressure Vessel Committee It does not include the contributions of tanks, freight bills or services. It is estimated that the value of the tanks alone used in this investigation amounted to some $15,000. The National Research Council acted as Treasurer for this project.

Funds Received

Contributor	*Amount*
Coast Culvert and Flume Company	$ 300.00
Brunswick-Kroeschell Company	300.00
Union Carbide and Carbon Research Laboratory	500.00
DeLaVergne Machine Company	300.00
York Manufacturing Company	300.00
The Pfaudler Company	300.00
The Vilter Manufacturing Company	300.00
The Elyria Enameled Products Company	300.00
The Travelers Indemnity Company	300.00
Total contributions	$2,700.00
Funds received for sale of tanks (purchased by G. W. Forsberg, Washington, D. C.)	99.50
Total Funds Received	$2,799.50

Funds Expended

Item	*Paid to*	*Amount*
Salaries of Research Associates at $200 each per month—November 28, 1922 to February 15, 1923	Maurice E. Weschler Joseph F. Scanlan	$1,040.00
Wages for machinist and laborers (2 months)	Maurice E. Weschler	37.74
Miscellaneous office supplies, facilities and expenses	American Welding Society	124.65
Travel	Maurice E. Weschler	372.80
Travel	H. L. Whittemore	46.30
Cuts for Bureau of Welding report	Pioneer Engraving Co	657.33
Pressure Vessel Bulletins	Standard Print Shop	435.50
Reimbursement—Crane & Company	Division of Engineering	.47
Sashcord, pulleys, etc.	Rudolph & West Company	1.65
Typing and mimeographing report	Commercial Office Service	53.27
		$2769.71
Bill to be submitted by American Welding Society for miscellaneous office supplies, facilities and expense		29.79
Total Funds Expended		$2,799.50

NORTHERN NEW YORK SECTION

START PROGRAM

The Northern New York Section of the American Welding Society opens the 1923-24 season with its fourteenth meeting September 24th at the Civil Engineering Building, Union College, Schenectady.

Mr. Addison G. Bissell of the Westinghouse Electric and Manufacturing Company will give a paper on "The Development and Application of Electric Arc Welding in a Navy Yard" and will illustrate his remarks by the use of lantern slides. Mr. Bissell has had experience with arc welding in the Navy during the late war and is well qualified to discuss the subject chosen. His talk will contain many items of interest to those concerned with welding or engineering in general. Mr. D. H. Deyoe of the Power and Mining Engineering Department, General Electric Company, will be the chairman of the evening.

The Northern New York Section has planned an extensive program of meetings with speakers representing various phases of the welding profession and allied subjects. These include Prof. Elihu Thomson of Lynn, Mass., Dr. C. P. Steinmetz and Mr. J. L. R. Hayden of Schenectady, Mr. E. M. T. Ryder of the Third Avenue Railway System, New York City, Mr. W. Remington of the Thomson Electric Welding Company, Lynn, Mass., Prof. A. S. Kinsey, Advisory Service Engineer of the Air Reduction Sales Company, Mr. G. O. Carter, Consulting Engineer of the Linde Air Products Company, and several others.

On September 28th, Prof. Elihu Thomson will give a talk on "The Early Days of Electric Welding," dealing with his pioneer work in this field during the early 80's. This meeting will be devoted to "Reminiscences" of the early days when welding was but a dream. Mr. Hermann Lemp of the Erie Works of the General Electric Company and Mr. W. S. Moody fo the Pittsfield Works will give short introductory talks on their work with Prof. Thomson during those days. Mr. Lemp will be the chairman of the evening on this occasion. This meeting will be a joint meeting of the American Welding Society and the American Society of Mechanical Engineers.

EMPLOYMENT SERVICE BULLETIN

Opportunities.—The Society is glad to learn of desirable opportunities from responsible sources, announcements of which will be published without charge in the Bulletin.

Services Available.—Under this heading brief announcements (not more than seventy-five words in length) will be published without charge to members. Announcements will not be repeated except upon request received after an interval of three months; during this period, names and records will remain in the office reference files.

Note.—Copy for publication in the BULLETIN should reach the Society's Office not later than the thirtieth of the month if publication in the following issue is desired. *ALL REPLIES should be Addressed to the Number Indicated in Each Case and Mailed to Society Headquarters.*

POSITIONS VACANT

V-12.—Need Supereintendent or Foreman of Electric Welding. Can always use some first class electric welders. Location Pennsylvania.

V-13.—Have an opening for a welder. Work Steady. Man expected at times to make guards and repair machinery. Must know how to weld by both gas and electric methods.

SERVICES AVAILABLE

A-19.—Want position in welding repair work. Have had about one year's experience in electric welding of tanks. Will go anywhere.

THE WELDING OF ALLOY STEELS*

C. J. HOLSLAG†

Once the theory of arc welding is understood, it would seem perfectly feasible to arrange for the deposit of any kind of alloy by simply introducing this alloy into the weld through the fusion of an electrode composed of the desired substance. This process, however, is not as easy as would at first appear, due to several causes. As a matter of fact, it has already been definitely stated that the absolute temperature of the arc is entirely too high for the simple melting of any metal. In actual welding practice, this temperature is reduced by various means—principally by holding as short an arc as possible, and by providing a surrounding mass large enough to absorb the surplus heat. This gives us the clue to the proper manipulation of the welding temperature, and makes clear the necessity for precaution in keeping the deposit unburned.

All commercial metals, especially iron and steel, contain a certain percentage of impurities, some of them desirable in the welding operation, and others a hindrance. It seems as if fate were intent upon allowing the desirable foreign substances to vaporize and escape at the high temperature of the arc, while the less desirable impurities remain behind. For instance, certain portions of the carbon, manganese, vanadium and other elements used in alloy steels will invariably escape when an attempt is made to deposit them in a weld. There is but one known method of depositing them intact, which is really a combination of two expedients. One of these is to incorporate in the weld certain compounds which produce inert gases, and so tend to minimize the oxidizing action under which the desirable impurities are burned out. The other is to provide the electrode with a heavy coating of some refractory substance, such as silicon, or silicon slag, which forms a physical coating about the bead and prevents oxidation.

In spite of these difficulties, the electric welding process has been developed to a point where it is perfectly possible to pass manganese, high carbon, nickel, chrome, or vanadium through the arc in any combination. It will at once be seen that there are excellent possibilities thus afforded, because most of these alloys give properties to the metal that are extremely desirable, especially where the original heat treatment can be duplicated.

As far as arc welding is concerned, the alloy nickel has been developed to the most useful extent. The use of this alloy in relatively small quantities, together with medium carbon, will produce a marked increase in tensile strength and other advantageous physical properties. Welds made with nickel alloys appear to

*Taken from Handbook to be published by the McGraw Hill Pub. Co.
†Chief Engineer, Electric Arc Cutting and Welding Co.

have a tendency to cause the appearance of what seem to be small incipient cracks on the surface. These, however, do not extend in use, and appear to be more in the nature of scale cracks. They may be made to disappear entirely by using a combination of nickel, chromium and carbon in the electrode.

All usable alloys of steel contain carbon. Small amounts of manganese invariably accompany this carbon, and in this quantity, is far from being undesirable for welding. Sulphur and phosphorus, however, are eminently undesirable in any amount, and unfortunately, there has as yet been developed no material aid in ridding the weld of their presence entirely. Silicon in or about the weld tends to float the sulphur and phosphorus to the surface, and so is helpful. It is best, however, to do away with these two impurities as far as possible in the electrode itself; then to provide means for holding the other and more desirable compound in the weld.

As already stated, certain alloys have been developed which are successful in being deposited thus intact, and one of the most remarkable as well as useful, is found in the combination of relatively high carbon, which will deposit a tool steel cutting edge on any mild steel base. The time seems not far distant when this process will become sufficiently well-known to eliminate the tool steel industry as such.

This process is sufficiently interesting to be described in detail. In ordinary welding, the metal is melted into a viscous mass, which usually has sufficient coherence to remain where it is deposited. In tool steel welding, however, the metal must be kept prefectly fluid and molten, and is prevented from oxidizing or spreading by being deposited in a trough built up around the welding area of some plastic and refractory material. This trough may be made by moulding carbon or carbon paste, graphite, asbestos, silicates or similar substances not affected by the arc, and is necessary because the metal must be prevented from running out of place while the required puddling action necessary to combine all the compounds in the weld is performed The metal is kept molten under the further protection of the slag covering of the electrode, which forms an envelope enclosing the metal while it crosses the arc from the electrode tip to the puddle.

This process is the only one in which the puddling operation should be thus performed. Other metals must be deposited relatively as cold as possible in order to insure a minimum of opportunity for the molten metal to absorb oxygen and nitrogen and so to burn out the desirable impurities. In depositing the manganese steel electrode upon rail joints, dredger buckets, and other hard surfaces, the large cold mass of the rail provides the necessary chilling treatment at first. This condition is usually continued by spraying cold water behind the steel weld as the work progresses.

The welding of springs, bumpers, axles, and other parts of alloy metal in automotive work is, in most cases, entirely feasible and useful. The breaking of leaf springs is usually met with in this connection, and their repair is usually entirely practical by the electric arc process. A spring is welded to the best advantage if it breaks near the eye, through the center bolt-hole, or if the break accurs in any one of the smaller leaves. If the break should be found to be isolated in one of the large leaves, the efficacy of the weld will not be as good as in the other cases. Fortunately, however, as springs are now built, breaks usually occur at the points first mentioned. It is perfectly feasible to weld a spring with every leaf broken in the center if the leaves are separated and welded one at a time, and the entire spring reassembled, after which if a pad or band is welded all around the entire spring, filling up the hole originally occupied by the bolt, the spring will be safe The bolt-head on the upped side of the spring may be duplicated by a welded button, and the rubber bumper bracket may also be tacked in place. All this work must not be done so rapidly or so continuously that the temper will be taken out of the spring. It is good practice to guard against this by dipping the spring in water at intervals, or by adding water to the welding surface.

If the break occurs near the eye it will be only necessary to deposit a sufficiently heavy pad to prevent any bending. When one of the smaller leaves is to be welded, before operations commence, the spring should be so clamped that each leaf bears its share of the load. In other words, each leaf must have its accustomed flexure or curvature while the weld is being made. While this condition usually demands skilled attention, it is not difficult to copy the original design when there are but one or two leaves broken.

Bumper breaks usually occur only in two places; where the bumper is bolted to the frame or bracket, or where the bend occurs. In welding a break at or near the bolthole, it is always good practice to provide additional strength by adding a generous pad where the break occured. For it is logical to suppose, that, if the section at this point was originally inadequate in strength, merely reduplicating it will not suffice, and therefore it is best to provide extra strength at this point. If the break occurs again, even after the extra padding has been added, it may be found expedient to grind or saw off the end so that the weld does not come at the hole. When the bumper breaks at a bend, it will generally be found that the defect was due to a flaw created in the bending process, and a weld made with ordinary care will be sufficient to correct the trouble permanently. When alloy axles break, there is no reason why their cross sections cannot be increased by a pad sufficiently heavy to obviate the recurrence of the break.

In all alloy welding done in automotive practice, the presence

of nickel in the welding rod is a very material aid in preventing the vaporization and escape of the desirable compounds of the alloy. An ordinary welding rod should not be used because it will allow these compounds to escape through the molten metal, and the beads formed will present a mushroom or gingerbread-like appearance. This is caused by the escaping gaseous oxides, which force their way through the molten weld. Practically every alloy has a much lower melting-point than steel, due mainly to the presence of carbon in these alloys in excess of that present in ordinary steel. This means that, in any case, the operator must exercise greater caution to prevent the burning-out of the metal.

In fine, as far as the development of alloy steel welding has thus far progressed, the best practice is found in duplicating the parent metal as far as possible in the electrode. In the great majority of cases, however, it has been found that various combinations of nickel in the welding rod will not only prevent the escape of alloy oxides, but that a nickel or a nickel-chrome electrode will sufficiently duplicate the physical properties of most alloys enough to produce entirely satisfactory results.

A nickel chrome welding rod deposited on a mild or carbon steel base will produce a weld possessing a tough, self-hardening surface that will prove ideal in resisting friction and wear. Where it is possible to effect no treatment but that of air-hardening, this deposit is often better than the original alloy for every purpose.

WELDING BLAST FURNACE ENGINE CYLINDER

Z. T. DAVIS

The impression may prevail in some quarters that large or complex gray iron castings can not ordinarily be welded. Yet, such castings are constantly being reclaimed and repaired throughout the country by the welding process. Expertness is not at all essential for this work as the successful welding of most gray iron castings is accomplished through conscientious operators merely following recognized good practices essential in this field of oxy-acetylene welding.

A cast iron welding job of real magnitude was recently performed on a forty-two inch blast furnace engine cylinder, weighing eight and one-half tons. The weight of this cylinder, the position and number of breaks and the thickness of the metal handled, demonstrate that the welding of cast iron is hardly limited by either the size or type of the casting.

The crosshead on the blast furnace engine gave way nad forced the piston through the lower head of the cylinder, which broke the head off and fractured it badly in six different places. The manhole, which sets into the cylinder head, was also broken in three places. Altogether the broken sections measured forty-

three feet six inches long and were through metal ranging from two inches to four inches in thickness.

Special rigging was necessary to handle the casting because of its weight and bulk. It was frequently neccessary to turn the casting during the welding in order to reach broken sections, and for proper reheating. The head, valve seats and other parts

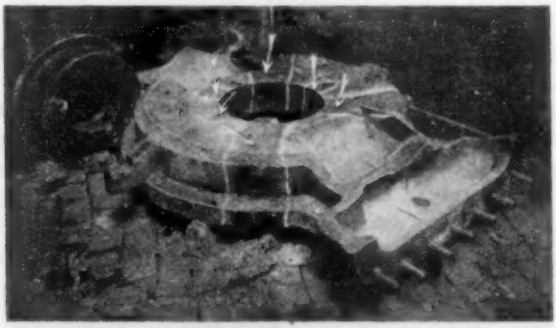


Fig. 1—Cylinder Head Welded in Six Places—Arrows Indicate Welds

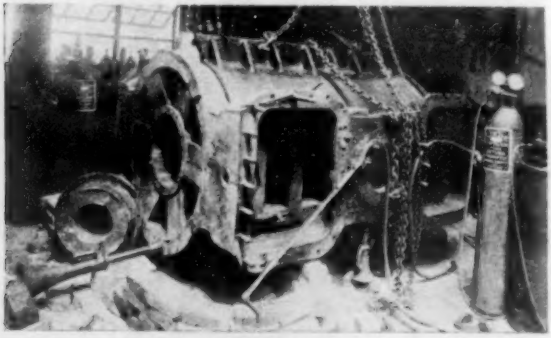


Fig. 2—Welded Head in Place Preparatory to Welding to Cylinder—Note Chamfered Sections

which were broken or fractured were welded first. Then the repaired sections were carefully placed and supported in the proper position and were then welded together and onto the cylinder. Considerable preparatory work was necessary to properly line up and hold the broken parts in place, as some were irregular in shape while others were in confined and difficult places to reach and weld. Overhead rigging, blocking, jacks and in some instances tack welding and pieces of steel welded to the broken parts to tie them together and which could be removed as the welding progressed were used to prepare the casting for preheating during the welding operations. Preheating was done entirely in temporary brick furnaces with charcoal fires. Care and thoroughness in carrying out this phase of cast iron welding is most essential to assure satisfactory results. Expansion and

contraction, due to the heat of welding, in castings of this size is considerable and must be compensated for or controlled by preheating, slow cooling and possibly annealing. The welding of a large casting like this cylinder, which has been broken in several different places, actually consists in making a number of separate welds, some of which may involve individual problems before being handled in relation to the job as a whole. The same practices and procedures which apply to the welding of single breaks and smaller castings apply, however, to the welding of large castings and compound breaks.

The materials used are further indicative of the size of this job. Nearly 400 bushels of charcoal and over 500 pounds of asbestos paper were used in the preheating. Forty cylinders of acetylene, 57 cylinders of oxygen and 600 lbs. of cast iron filler rod were used in the welding.

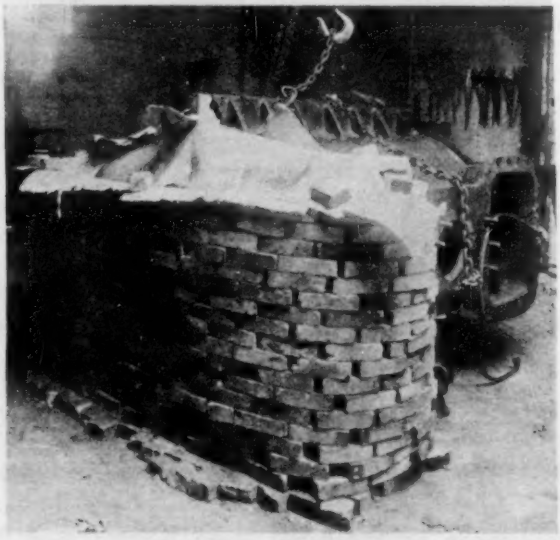


Fig. 3—Temporary Charcoal Preheating Furnace Used in Welding Head to Cylinder

Six men required nine days to do the welding, which included the time required for preparation, preheating and cooling. The actual welding only required slightly more than half this time. A considerable amount of machining was necessary to test the welding, rebore the cylinder, reset the broken valve seats and other finishing work. The entire repair took three weeks, which might appear long were it not that the steel mill owners could not have obtained a new cylinder in less than nine weeks and therefore saved a six-week shut down in addition to a considerable difference between the cost of oxy-acetylene welding and the casting of a new cylinder.

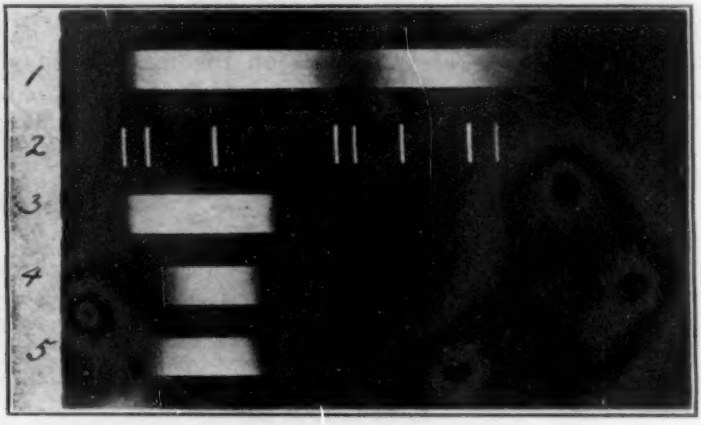
NOTES ON SAFETY GLASSES FOR IRON WELDERS

W. S. ANDREWS †

High authorities differ in their opinions regarding the relative danger to the eye, incurred by undue exposure to infra-red, and ultra-violet radiations and X-rays.

The common opinion appears to be that the infra-red radiations are comparatively harmless, because when they are intense enough to injure, they are felt as heat, and the individual is thus warned. On the other hand, it is believed that ultra-violet radiations begin to be dangerous to the eye at a wavelength of about 305 millimicrons, and are increasingly abiotic as the wavelengths become shorter, the danger being intensified by the fact that we are not provided by nature with any nerves sensitive to these radiations, by which we would be warned of their presence.

It is nevertheless asserted by high authority that the eye itself is so constituted that ultra-violet radiations and x-rays cannot penetrate its substance, so it is immune to them, although the



mucous membrance and surrounding tissues may be affected thereby in a manner somewhat analogous to sunburn, but often producing more serious effects.

It is also authoritively stated that severe injury to the eye itself both externally and internally, may be produced by the *extreme red* and infra-red radiations as they actually penetrate the eye-ball. For example, the disease well known as "glass-blowers catarat," which is causd by prolonged proximity of the gas-jets to the operator's eyes.

† Consulting Engineer, General Electric Co.

We know that these "hot fires" produce an abundance of infra-red or heat rays but practically no ultra-violet radiations.

In consideration of these diverse opinions, it appears that the only safe course is to provide safety glasses that are opaque to radiations at both ends of the spectrum. It is well-known, that the human eye is visually more sensitive to the yellow and yellow green rays from, approximately, 545 to 585 millimicrons than to any other of the spectrum. It therefore follows that a safety glass which will pass practically no rays, either visible or invisible, other than those within the above limits, will show the clearest possible definition of work, with the lowest possible total transmission, and it should therefore be an *ideal* safety glass.

A slight filter, as above described, can be made with gelatin or celluloid films colored with anilin dyes, but unfortunately these screens soon become spotted or discolored when exposed to the heat radiated from the molten iron even when protected by plates of clear glass. Colored glass appears to be the only material that will bear the necessary temperature conditions indefinitely, but the writer has not yet seen any safety glass that meets these color qualification exactly. There are, however, a few safety glasses on the market which are fairly good, although in general, they are too transparent to the red rays and infra-red heat rays.

Figs. 3, 4 and 5 in the cut represent the transmission spectra of three of the best safety glasses on the market today. The negatives were made by the light of a 5 ampere D. C. carbon arc, the continuous spectrum of which is shown in Fig. 1. Fig. 2 is the spectrum of Helium to indicate location.

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WELDING CAST IRON WITH A SPECIAL NICKEL COPPER ALLOY WELDING WIRE

ALEXANDER CHURCHWARD†

Recently we have developed a successful method of welding cast iron involving a new principle of absorbing the carbon contained in the cast iron, forming thereby at the juncture of the weld a new alloy which not only insures strength equal to that of the original castings, but also permits ready machining. This is accomplished without preheating, annealing or the use of studs.

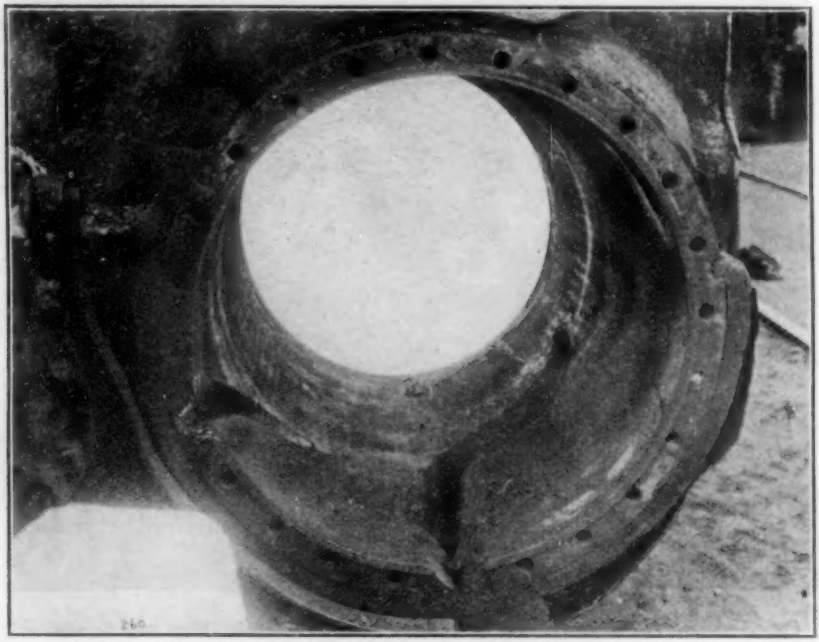


Fig. 1—Close-up of crack of engine cylinder prepared for welding. Cost of new cylinder, $1,450. Cost of applying new cylinder, $350.

It has already been used extensively in reclaiming defective castings and repairing those broken in service. Examples are shown in the accompanying figures.

This method of welding cast iron possesses the following advantages:

1. Most grades of cast iron can be welded.
2. Welds are as strong as the parent metal.
3. Necessity for studding or preheating is eliminated.
4. Welds can be as readily machined as carbon steel.

† Wilson Welder & Metals Co.

This welding is done with a special nickel copper alloy of the following composition:

Nickel	*Manganese*	*Sulphur*	*Iron*	*Copper*
66-68%	1.00-2.00%	Max. .09%	1.00-3.00%	27-30%

It flows through the arc very differently from any other welding metal, consequently one must become accustomed to using it and not expect to attain perfect results with the first attempt.

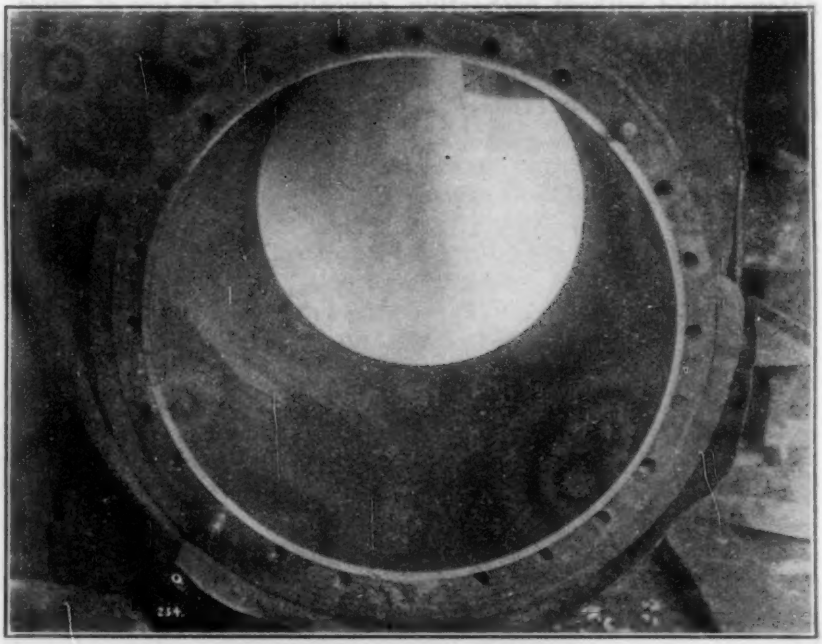


Fig. 2—Cylinder shown in Fig. 1 after being machined. No studds were used in welding these cracks. About 75 lbs. metal used in welding. Total cost of welding about $200.

The co-efficient of expansion of the wire closely approaches that of grey iron and therefore when it has been deposited, it does not pull away from the grey iron, as does a steel electrode.

To insure the best results the electrode should be deposited on a cold section of the casting to be welded and a bead not longer than 2″ deposited at one time. When this bead is laid, it should be carefully peened with a light ball peen hammer. This produces a forged effect in the metal and relieves it of the strains due to cooling, closing up what heat cracks might have developed.

When using this special nickel copper alloy to weld a casting in which there is a pressure or a vacuum, after the Vee or opening has been padded with two layers of metal, all of course, having been peened as per above, the entire weld should be thoroughly

and carefully caulked, either by hand, or with a pneumatic tool. Caulking should be continued after every second layer is finished and when the opening or Vee is entirey filled in with metal the whole mass should again be caulked and also gone over with a roughing tool.

Particular care should be taken to deposit each 2″ bead on cold metal and it is therefore necessary to keep moving from one part of the casting to the other.

In cases where the finished weld is to be machined the opening or Vee should be filled in above the line of the finished surface, approximately 3/16″ for machining. A tool will readily cut

Fig. 3—Broken locomotive cylinder of National Railways of Mexico repaired by their own operators. Bore of cylinder was machined without any difficulty.

through the finished weld and through the parent metal without jumping, but it is advisable to slow down the cutting speed and also to see that the tool is very rigid.

When a casting has been partly filled in with a steel electrode, and a machined surface is desired, the above procedure should be followed, but it is only necessary in this case to use the nickel copper alloy for the last two or three beads of the weld.

The current recommended for using .148″ (5/32″) diameter, is 175 amps. and a short arc. This means that an average current in the arc of 175 amps. should be maintained.

Welding cast iron must necessarily progress slowly and if the above suggestions are followed, satisfactory results will be attained.

A NEW FIELD FOR OXY-ACETYLENE WELDING

T. C. FETHERSTONE

Another progressive step in the use of tighter and cheaper pipe joints was made during the past few months, when all oxy-acetylene welded casing was installed in two artesian wells. This is some what of an innovation for artesian well contractors as heretofore screwed joints have been used exclusively. The satisfactory results obtained demonstrated the superiority of joints for artesian well casing and it is reasonable to expect that the old practice of using screwed joints will soon be entirely supplanted by welding.

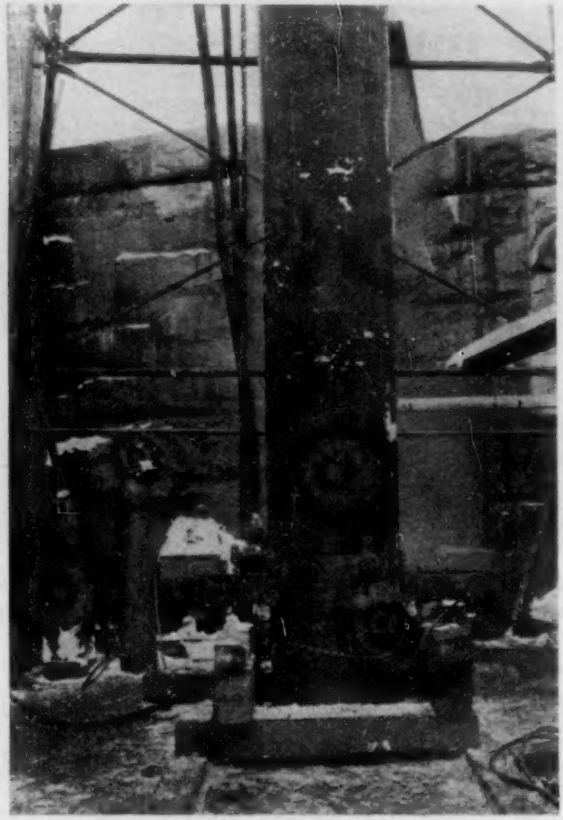


Fig. 1. Joint Ready to be Welded

A large artesian well contractor in the East having observed the progress and improvements in other pipe fields through the applications of oxy-acetylene welding and cutting, perceived the potential value of welding joints of artesian well casing, if practical and economical methods could be employed. Being un-

familiar with the process he presented his problem to welding engineers for advice and assistance.

Oil well casing has been advantageously welded for years, and although artesian well casing is usually larger in diameter, the engineers were able to apply much of the practical experience they had accumulated in the older field of welded oil well casing. Working in close harmony with the engineers of the artesian well contractor, the welding engineers soon worked out in their own shop and laboratory a type of welded joint which promised to give the best results. The contractor was convinced of the practicability of the work and made immediate preparations to weld the casing for an artesian well then being sunk in New Jersey.

Fig. 2. Welded Lugs on Each Section of Casing

This well required nine twenty-foot lengths of steel pipe, eighteen inches in diameter with walls five-sixteenths inch thick. The total length of the well casing being 180 feet. In accordance with plans prepared by the welding and contractor's engineers, four lugs one and one-half inch by eight inches by five-eighths inch thick were welded on the outside of one end of each section of pipe, with half the length of the lug extending beyond the end of the pipe.

The standard type of erecting gear used for the installation of casing with screwd joints was used to install the welded casing. It consists of a derrick equipped to handle long lengths of pipe and carry the weight of the entire casing.

Immediately after boring operations had been completed in-

stallation of the welded casing began. The first section was lowered into the well and held in position with its upper end just above the ground and at a convenient height for welding, by a clamp which was supported on blocks of wood. The second section of pipe was lifted to an upright position with one end on top of the first section. Then the lugs which had been welded to the latter were welded to the second section, after which a circumferential weld was made to complete the joint between the two sections.

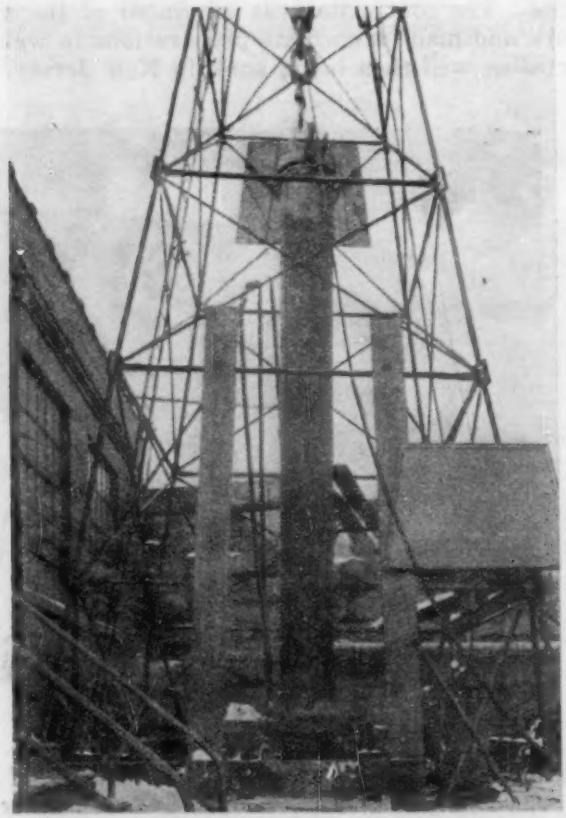


Fig. 3. Erecting Gear Used to Handle Casing

To properly allow for contraction, sections of casing were prepared for welding by separating them about one-sixteenth inch with small steel wedges. These spacers were later melted into the joint as the circumferential welding progressed. When a joint was completed another clamp was attached to the top of the upper section and the weight was lifted off the lower clamp; it was removed and the completed sections were lowered into the bore until the second clamp rested on the blocking. Then the work proceeded in the same sequence until completed.

It is essential that well casing be sunk without unnecessary delay, once the bore has been completed, otherwise there is a possibility of the hole filling up and preventing the casing being sunk to the proper depth. Provision is usually made to complete the installation of the casing within 24 hours after the boring has been completed. To accomplish this and at the same time help in further controlling the effect of contraction and expansion, two operators were employed to make the circumferential joints, each welding in the same direction on opposite sides of the casing.

As the welded lugs have sufficient strength to carry the entire weight of the casing and as this is reduced by the water in the well and casing which exerts an appreciable upward force, the circumferential welds are not required to carry any weight. It is only necessary that they make the casing tight. These factors having been determined by the engineers in advance precluded the necessity of beveling the edges of the casing. The circumferential welds were made perfectly tight by penetrating the wall of the casing to only one-quarter of its thickness.

The oxy-acetylene welded casing for the New Jersey well proved so satisfactory that the same contractor soon afterward adopted the process for fabricating casing for a second well in Pennsylvania. This casing 120 ft. long, in six twenty foot lengths, was twenty-four inches in diameter and five-sixteenths inch thick.

The lugs on the first casing it developed were unnecessarily heavy, so lighter ones measuring one and one-half inches by six inches, by three-eighths inch thick were used on the second casing and proved just as satisfactory. Except for the lugs, procedure and methods of fabricating the second casing were the same as employed on the first and both installations received the unconditional approvel of the contractor and well owners.

The second casing was installed entirely by the contractor's own men, although a service operator was present to assist the welders in following the instructions they had been given on the first job. This contractor proposes welding many more casings in the near future and his own men are fully capable of carrying on the work now without assistance.

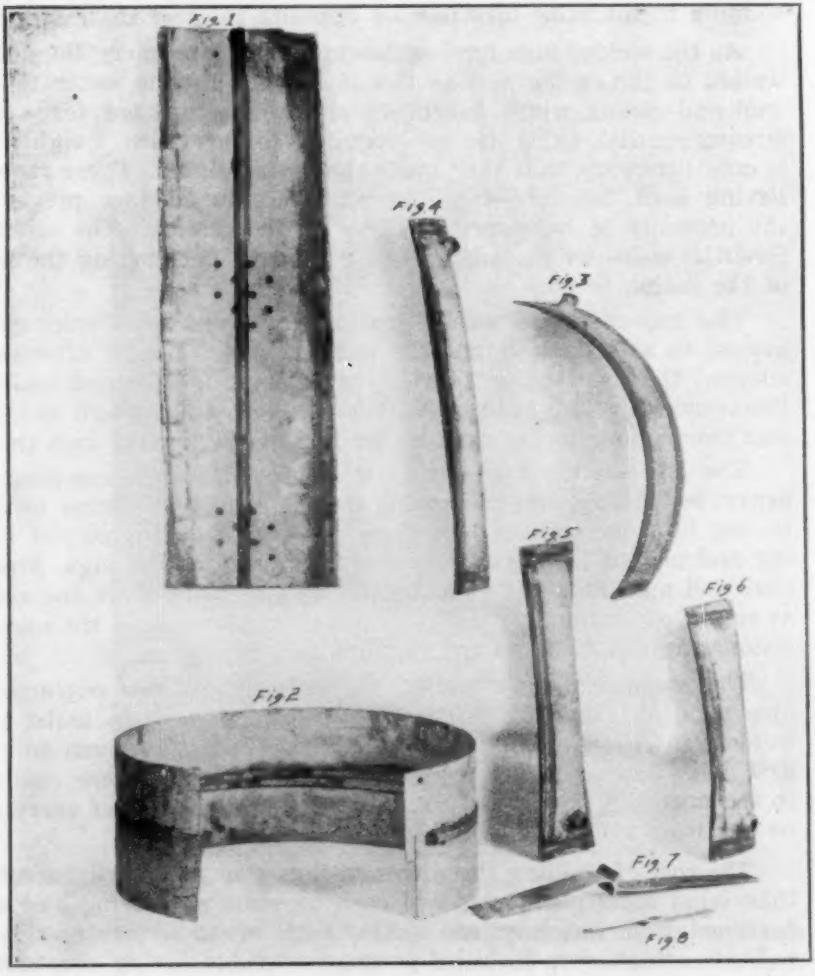
The cost of welding these two casings was necessarily greater than what subsequent ones will cost, as some pioneering and experimentation was required. Yet, both of these oxy-acetylene welded casings were installed at a considerable saving over what they would have cost had they been assembled with screwed connections and the welded construction assures in addition greater strength and permanent tightness.

RESISTANCE WELDING OF SHEET METAL.

H. W. TOBEY †

The accompanying illustrations show some of the numerous applications of resistance line welding to various forms of sheet metal.

An example of flat sheet welding is shown in Fig. 1, this being



made by lapping the two sections of the sheets one over the other, and running the weld along the ovrlapping surfaces. Fig. 2 shows a similar lap-weld with the exception that the sheets were formed into circular shape before being put into the machine.

* Continuation of a Report presented at the annual meeting of the American Welding Society on "Recent Developments in Resistance Welding Field" and published in the June 1923 issue of Journal.

† Pittsfield Works, General Electric Co.

Figs. 3, 4, 5 and 6 show forms of test pieces made up for the purpose of determining the strength and tightness of straight as well as circular welds. These samples were made by placing together two sheets of steel, one over the other, and line welding them close to the edge, both along the sides and across the ends.

They were then tested under hydraulic pressure through the pipe fitting previosly welded into one of the sheets near the end. Under these conditions the sheets bend almost at right angles next to the weld and assume the shape of a tube, thus tending to split the welds open.

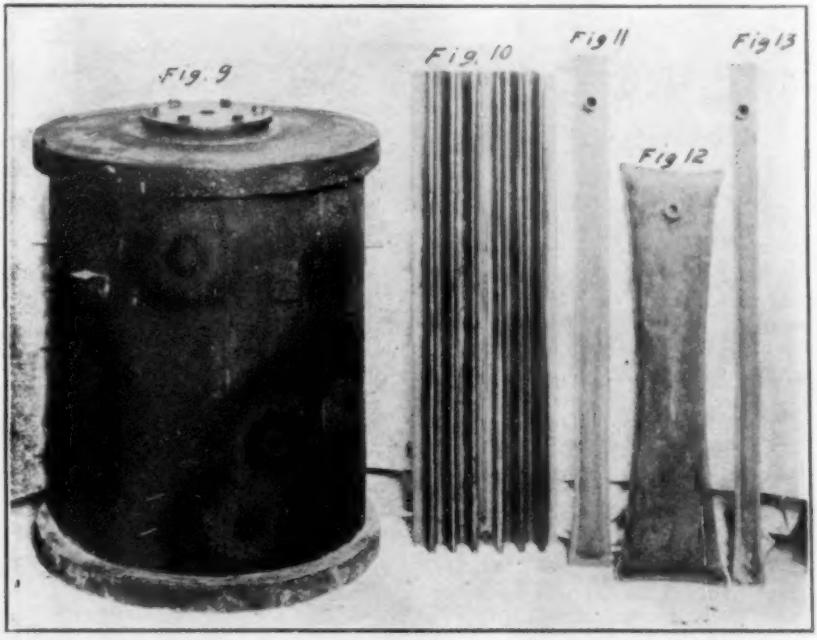
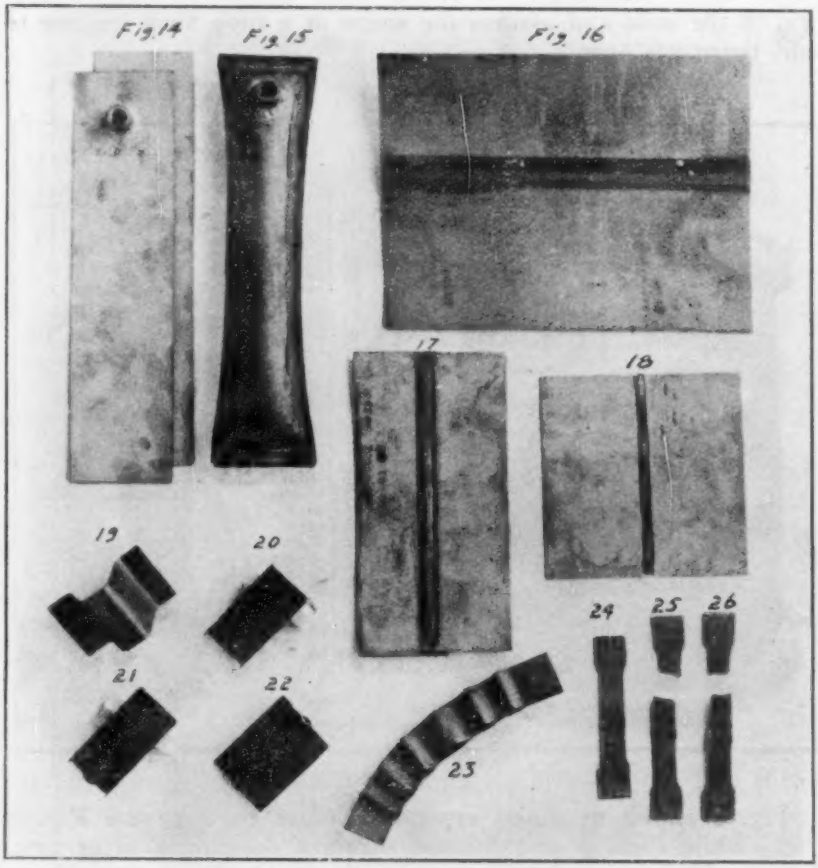


Fig. 3 shows a curved specimen before testing, and Fig. 4 after, while Figs. 5 and 6 show straight specimens after test. The sample shown in Fig. 6 was one of a number tested for tightness up to 400 lbs. per square inch. The curved specimen, Fig. 4, burst at 1500 lbs. per square inch, not in the weld, but along the right angle bend mentioned above. The straight specimen, Fig. 5, burst in a similar manner at 2100 lbs. per square inch, not in the weld, but along the bend.

This form of test piece has been found convenient and useful for testing welds made under various conditions, such, for example, as varying thicknesses of metal, varying currents, speeds, etc. Any tendency toward weakness or brittleness is readily detected, while the smallest kind of a leak shows up immediately.

Specimens shown in Figs. 7 and 8 were cut from welded sheets and tested with a cold chisel. Hammering, bending or twisting failed to open the welds.

Fig. 9 shows a small test tank approximately 22 inches in diameter by 30 inches high, built for the purpose of still further determining the strength and tightness of resistance welded seams. The shell was made by lap-welding a number of strips of



1/16" stock. The current in this case was approximately 6000 amperes, and the speed 30 inches per minut. Following this, headers were cast on to each end.

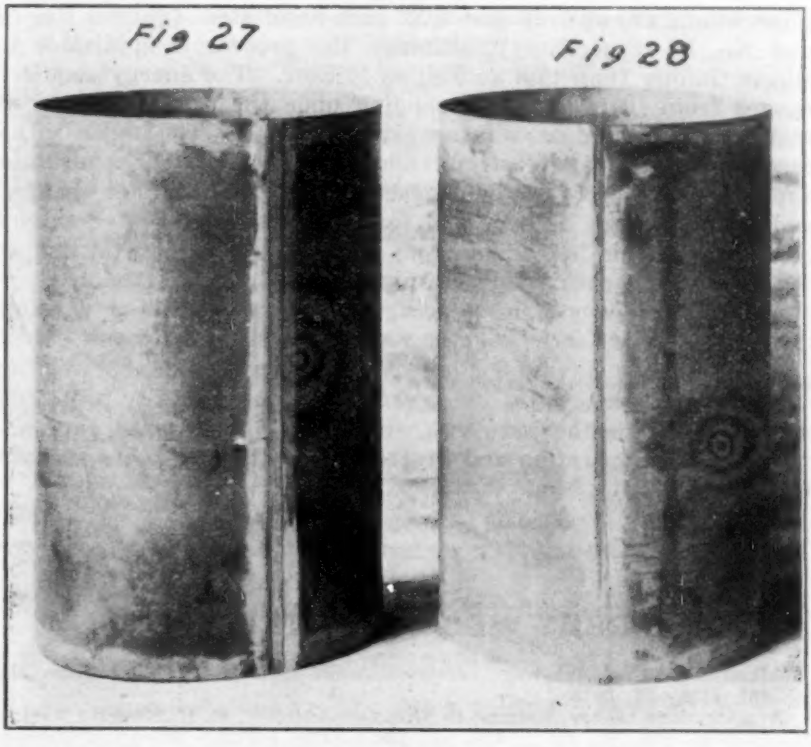
The completed tank was filled with water and subjected to a hydraulic test sufficient to place the shell under a tensile stress of approximately 48,000 lbs. per square inch. No sign of any leak appeared either in the lap-welded seams or between the shell and cast iron headers.

In Fig. 10 is shown a fluted or corrugated sheet, the sections of

which were joined by the resistance line welding method.

Figs. 11, 12 and 13 illustrate various sizes and shapes of resistance welded tubes or containers tested under hydraulic pressure to determine the strength and tightness of the welds.

Figs. 14 and 15 illustrate two additional test pieces, the former showing the flat sheets before welding, and the latter a similar specimen after having been welded and then tested under hydraulic pressure. The welding current in this case was about 7500 amperes and the welding speed approximately 36 inches per minute. Under test the sample withstood a pressure of somewhat over 2000 lbs. per square inch, opening at about 2100 lbs. at the right angle bend next to the weld.



Samples of flat sheet steel, lap welded, are illustrated in Figs. 16, 17 and 18. Specimens 16 and 17 were lapped and then line welded without any special preparation other than sandblasting, while in the case of 17 the edges were scarfed before welding. The finished sheet in the latter instance is practically the same thickness throughout.

Special channel and small I beam sections are shown in Figs. 19 and 20, while 21 and 22 are sections from heating units.

The specimen shown in Fig. 23 was prepared by running a

series of parallel line welds across the sheets, then attempting to tear them apart by driving a cold chisel or drift-pin between the seams. No amount of hammering could open the welds.

Several resistance welded tensile test samples, out of a large number prepared, are shown in Figs. 24, 25 and 26, the former before being pulled apart, the latter, after. The breaks occured in the parent metal, well away from the welds, at values between 48,000 and 50,000 lbs. per square inch for this particular kind of steel.

In Figs. 27 and 28 are shown resistance welded shells or casings, such as are being used in the construction of transformer tanks. In this connection the sheets are cleaned along the edges, then formed into shape, lapped and welded along the entire length.

For the most part the specimens shown in the accompanying illustrations are of 1/16 and 3/32 inch sheet steel (gauges No. 16 and No. 13 respectively), although the process is applicable to sheets thinner than this as well as thicker. The energy required ranges from 10 to 50 kw. depending upon the thickness, kind of material and speed at which welds are made. The welds in all cases are mechanically strong and oil tight as well as neat in appearance. Moreover, the character of the metal is not changed and the welds can be bent and formed without fear of cracking them open. This is evident from the fact that the metal during the welding operation is maintained slightly below the melting point, in other words, it is brought up to a plastic or welding temperature and forced together while in this condition.

Still another advantage possessed by the resistance welding method is that the eyes of the operator do not need to be protected either with gogles or otherwise, since only a bright red glow accompanies the operation and proceeds with the electrodes as they move along their path.

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BOOK REVIEW

Fundamentals of Welding—Gas, Arc and Thermit, by James W. Owens, Published by the Penton Publishing Co., Cleveland.

This book includes among other things the results of research work conducted at the Norfolk Navy Yard to determine the relative importance of the various factors affecting the making of welds and their bearing on each other and on the completed structure. A list of the chapters is Classification and Nomenclature; Preparation and Finish; The Gas Weld; The Arc Weld; Technic of the Arc Weld; The Thermit Weld; Gas and Arc Cutting; Metallography of the Weld; Residual Stresses; Speed and Cost of Welding and Cutting; Choice of Methods; Design; Inspection and Tests; Production and Distribution of Oxygen, Hydrogen and Acetylene; Arc Welding Generators and Transformers; Welding and Cutting Machines; Welding Rods, Electrodes and Fluxes; Protectors and Safety Precautions; Organization, Shop and School Layouts; Training; A Practical Arc Welding Course; Standard Specifications; Practical Applications; Summary and Conclusions.

VALUE OF MEMBERSHIP IN THE AMERICAN WELDING SOCIETY

1. The American Welding Society is a national organization representing the highest standards of the welding industry.

2. The work of its various committees is an important and valuable factor in developing, stabilizing and standardizing the entire welding industry.

3. Membership will help increase your knowledge of welding and help you to improve your application of the process.

4. You are offered many opportunities to make personal contact with the leaders of the industry.

5. You will profit by the experiences of the finest trained minds in the welding industry—experience which will save you money.

6. You will receive a monthly publication giving reliable data on the development of the art.

7. By supporting the Society you will help raise the standard of welding efficiency and help to increase the number of efficient welders.

8. Section meetings and publications of the Society offer a medium for the presentation of your knowledge of welding and the discussion of the views of others.

9. Your support will help the Society to counteract adverse legislation and other activities which may not only retard progress of welding but also affect your business.

10. Increased membership will help us carry out new activities, will help us maintain departments, which at the present time our limited finances will not permit, such as Employment Bureau, Library Facilities, Standardization Work, etc.

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These bulletins are published under the auspices of the American Bureau of Welding. The Bureau is the joint Advisory Committee of the American Welding Society and the Division of Engineering, National Research Council on Welding Research and Standardization. It acts as the Research Department of the Society. In addition to these bulletins a large number of other reports have been made available to the welding industry, through the medium of the Journal of the American Welding Society.

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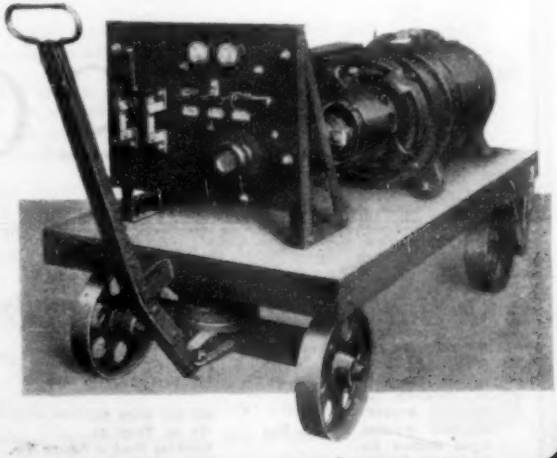

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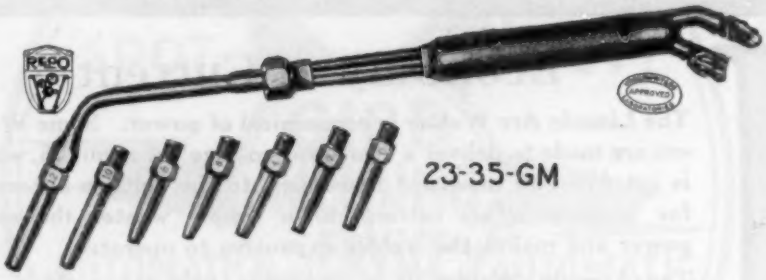

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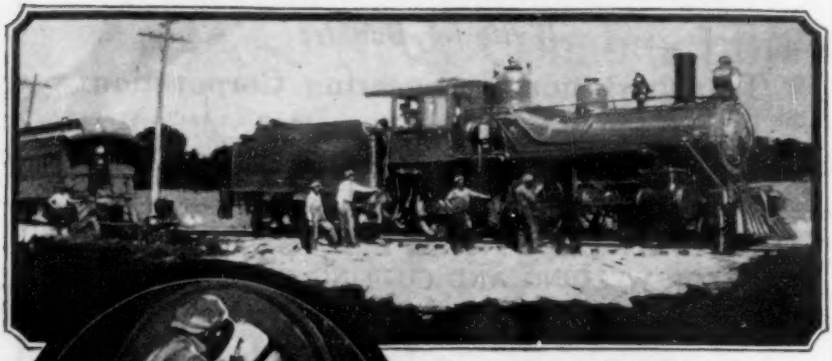

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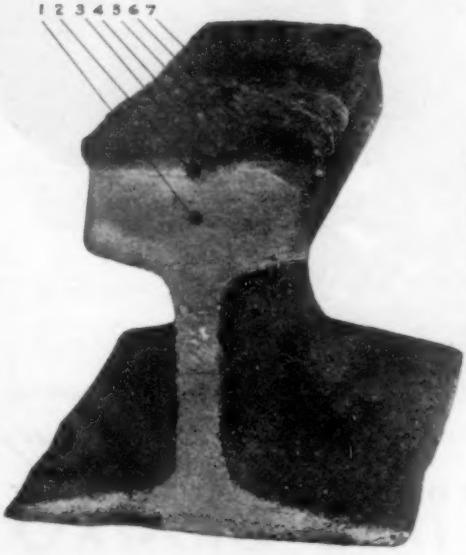

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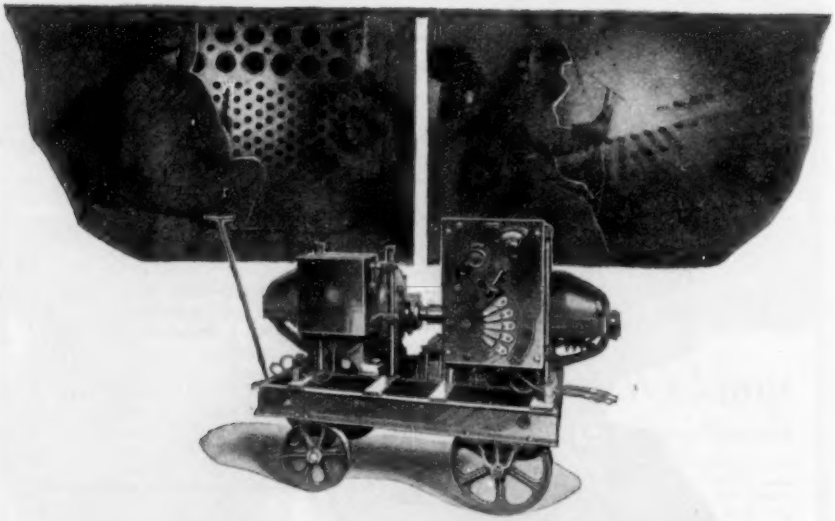

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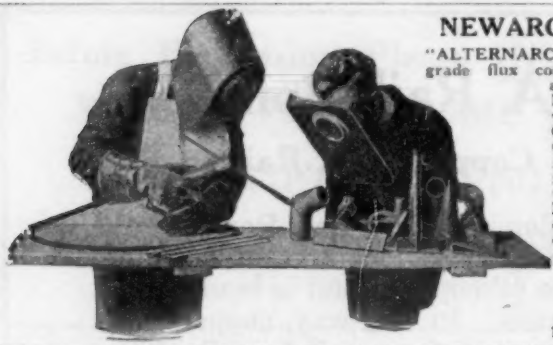

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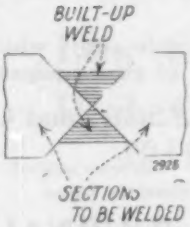

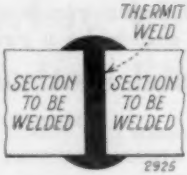

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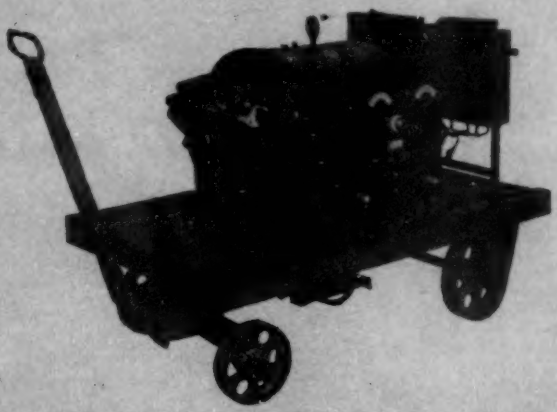

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